Green Carbon Center takes all-inclusive view of energy

October 22 2010

Rice University has created a Green Carbon Center to bring the benefits offered by oil, gas, coal, wind, solar, geothermal, biomass and other energy sources together in a way that will not only help ensure the world's energy future but also provide a means to recycle carbon dioxide into useful products.

Whether or not one believes in anthropogenic climate change, the fact is humans are throwing away a potentially valuable resource with every ton of carbon dioxide released into the atmosphere, said James Tour, Rice's T.T. and W.F. Chao Chair in Chemistry as well as a professor of mechanical engineering and materials science and of computer science. Far from being a villain in the global warming debate, carbon will be a boon if the world can learn to use it well, he said.

"The key is to turn carbon dioxide into a useful material so it's no longer waste," he said. "We want the center to partner with energy companies -- including oil, natural gas and coal -- to make carbon a profitable resource."

A number of strategies are detailed in a paper in today's online edition of Nature Materials by Tour, Vicki Colvin, Rice's Pitzer-Schlumberger Professor of Chemistry and of chemical and biomolecular engineering, and Carter Kittrell, a Rice research scientist.

Tour said the paper presents a taste of what Rice's new center intends to be: a think tank for ideas about the future of energy with a focus on

green carbon and the technological know-how to back it up. As part of Rice's Richard E. Smalley Institute for Nanoscale Science and Technology, the Green Carbon Center will draw upon the combined knowledge of the university's nanotechnology experts, for whom the development of clean and plentiful energy is a priority.

"Eighty-five percent of our country's energy comes from fossil fuels, and Houston is the world capital of the industry that makes and produces and transports those fossil fuels to all of us," Colvin said. "So we are in a unique position as the leading university in Texas to transform that industry, to develop it in a green way, to make it sustainable and to teach people that just because it's carbon doesn't mean it has an environmental consequence, but it can in fact help us transition to a renewable energy economy of the future."

"The whole idea," Tour added, "is to lower the carbon dioxide footprint and to show you don't have to get rid of anybody's energy source.

"We want to say to the oil and gas and coal companies that even as we go to renewable forms of energy, we need you. We need oil for all of our manufacturable products -- plastics and fibers and building materials," he said. "We need coal for syngas and for the manufacture of chemical compounds. And we need natural gas to provide energy at least into the next century, as well as for the production of hydrogen."

The Rice researchers wrote in *Nature Materials* that the rapid expansion of solar and wind energy and the promise of a hydrogen-based energy economy do not negate the continuing, long-term need for carbon-based energy, particularly since so many American jobs depend on the digging, drilling and distribution of fossil fuels.

They suggested carbon dioxide separated from hydrogen through steam methane reformation could either be repurposed immediately as a basic

feedstock for chemicals or sequestered temporarily in tapped-out oil wells, which would hold vast amounts. Compressed and liquefied carbon could even replace another precious resource -- water -- to enhance oil and gas recovery.

"It costs a lot to capture carbon dioxide and pump it underground, and that can negate the advantages of sequestration," Tour said. "But solar and wind power could replace coal-fired boilers to compress and transport carbon dioxide."

If an efficient catalytic process can be developed, water-based conversion of carbon dioxide back to methanol, formaldehyde or other small molecules "would be a tremendous scientific advance for humanity," the authors wrote.

They also noted a potential market for carbon dioxide in dry cleaning, where it could replace harmful chlorocarbons, and as a refrigerant to replace materials more than 1,000 times as potent as greenhouse gases.

More information: Read the *Nature Materials* article at www.nature.com/nmat/journal/v9 … 1/full/nmat2887.html

Provided by Rice University